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A document containing several articles is announced as complete volume under an HS number referring to it as a whole. Entries for individual articles are listed under their own HS numbers.

SAMPLE ENTRIES

JOURNAL ENTRY

Title of Document	{	SYNTHESIS OF CASE LAW JURISPRUDENCE RELATING TO WET-WEATHER HIGHWAY CONDITIONS
Journal Citation		Highway Research Record n 376 p29-36 (1971)
Author(s)	{	D. C. Oliver 1971
		Sponsored by Highway Res. Board Steering Com. for Workshop on Anti-Skid Program Management and presented at the workshop.
Search Terms	{	Descriptors: *Liability, *Negligence, *Accident responsibility, *Legal responsibility, *Wet road conditions, *Court decisions, *State government, *Skidding accidents, *Warning signs, *Highway maintenance, *Litigation, *Icy road conditions,
Abstract		The extant case law on legal liability for accidents occurring on icy and wet highways has established three central areas and one subarea in the jurisprudence of maintenance liability. These areas are compliance with general duties in order to escape liability; damages resulting from noncompliance (negligence); contributory negligence as a bar to recovery; and advisory signing as a technique in meeting general duties. Court decisions covering these four areas are presented.
NHTSA Accession Number		HS-012 289
		*Subject heading in Subject Index

CONTRACT REPORT

	{	EQUIPMENT AND PROCEDURES FOR MEASURING GLARE FOR MOTOR VEHICLES. FINAL REPORT
Corporate author		Teledyne Brown Engineering
Availability	{	N. E. Chatterton J. D. Hayes E. W. George 1972 102p
		Contract DOT-HS-089-1-139
		NTIS
		Descriptors: *Glare, *Glare reduction, *Visual perception, *Photometers, *Luminance, *Hydraulic equipment, *Central vision, *Field of view, *Backgrounds, *Contrast, *Light conditions, *Brightness, *Test facilities, *Test equipment, *Vehicle safety standards, *Simulators, *Light, *Reflectance, *Measuring instruments,

A procedure and description of equipment for measuring glare from a driver's own vehicle are presented. The procedures are based on a disability glare theory as applied to foveal vision. Two pieces of apparatus were constructed to provide the measurement capability. One of them simulates diffuse sky glare and the other simulates direct solar glare. Methods of combining data from these measurements are presented along with scaling laws selected to provide a value for glare as it would be under natural daylight conditions. A standard for allowable glare levels from the vehicle is developed which is independent of the measurement procedure. Test results from a passenger car are presented and compared with this standard. Recommendations for improvements to the apparatus and additional research requirements for improvement to the

ACCIDENTS

B. Injuries

AUTOMOBILE INJURIES--THE FORGOTTEN AREA OF PUBLIC HEALTH DENTISTRY

F. Huelke, H. W. Sherman 1973 11refs
Journal of the American Dental Association v86 p384-93 (Feb 73)

Accident injuries, Injury case reports, Injury causes, Injury prevention, Dentists, Teeth, Head on collisions, Side impact collisions, Windshield caused injuries, Laminated glass, Steering wheel caused injuries, Instrument panel caused injuries, Impact caused injuries, Child restraint systems, Three point restraint systems, Seat belt effectiveness, Physicians and highway safety, Professional role, Accident investigation, Injury severity

Although vehicle design changes have significantly decreased the severity of body injuries, the orofacial region is traumatized one fifth to two thirds of those injured. Impacts with the instrument panel, steering wheel, windshield, or other forward structures cause a wide range of orofacial injuries that are routinely treated by the dentist. However, the expertise of the dental profession has not been focused on the preventive aspects of orofacial injuries received in car crashes. These could be implemented, through national dental leadership and encouragement of three point and child restraint system usage by the practicing dentist.

S-013 290

ESTIMATING THE EFFECTS OF CRASH PHASE INJURY COUNTERMEASURES--2. THE FATALITY TRENDS AND ITS MODIFICATION BY COUNTERMEASURES.

C. Joks, H. Wuerdemann 1973 36refs
Based on work done under contract FH-11-7229. The complete report is available from NTIS as PB-191 209.
Accident Analysis and Prevention v5 n1 p1-26 (Apr 1973)

Fatality prediction, Fatality rates, Accident risk forecasting, Statistical analysis, Vehicle age, Vehicle mileage, Driver age, Fatalities, Seat belt usage, Safety device effectiveness, Energy absorbing steering columns, Compact automobiles, Vehicle size, Speed, Vehicle registration, Regression analysis, Rural highways, Interstate highway system, Fatality causes, Accident risks, Door locks

The trend of automobile occupant fatalities from 1950 to 1968 has been studied. The influence of such factors as vehicle age, improved doorlocks, small cars, speed, seat belt use, driver age, and the Interstate Highway System was estimated on the basis of past studies. The relation of 20 other factors to this trend has been explored by regression analyses. No satisfactory representation of the trend could be achieved without including either new automobile registration data or the Index of Industrial production in the independent variables. A hypothesis explaining this was proposed. The number of automobiles, by model year groups corresponding to the availability of crash phase countermeasures, involved in potentially fatal accidents, was projected to 1968. Applying the reduction in fatality risk to these figures, fatality trends with countermeasures are projected to 1980 and compared with a projection assuming no countermeasures.

S-013 292

1C. Investigation And Records

DETECTION OF DEFECTS IN ACCIDENTS

Michigan Univ. Hwy. Safety Res. Inst., M40800
J. O'Day, W. L. Carlson 1973 7p 2refs Rept. No. SAE-730584
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Accident analysis, Failure caused accidents, Automobile defects, Accident causes, Brake failures, Tire failures, Accident records, Police reports, Failures, Accident rates, Vehicle maintenance, Inspection effectiveness, Warning systems, Accidents by vehicle age

Several sets of police-reported and in-depth traffic accident data were analyzed with respect to the involvement of vehicle malfunctions or defects in accident causation. It was concluded that accident causing defects are inconsistently reported; are often attributable to the lack of appropriate maintenance practices; and are evidently not being corrected by present motor vehicle inspection systems. Although the automotive engineer has already built into the vehicle many detection systems which serve notice to the vehicle owner/operator that a component needs attention, it is suggested that further efforts in this direction may supplement state authorized periodic inspection programs in minimizing the incidence of vehicle defects in accidents.

HS-013 262

FAULT-TREE APPLICATIONS TO THE AUTOMOBILE INDUSTRY

Booz-Allen Applied Res., Inc., B20400
For primary bibliographic entry see Fld. 5D.
HS-013 265

FAULT-TREE APPLICATIONS TO THE AUTOMOBILE INDUSTRY

Booz-Allen Applied Res., Inc., B20400
For primary bibliographic entry see Fld. 5D.
HS-013 265

TRAFFIC SAFETY: PROBLEMS AND SOLUTIONS

For primary bibliographic entry see Fld. 3D.
HS-013 281

TRAFFIC ACCIDENTS--A MODERN EPIDEMIC

M. MacKay 1972 8refs
International Journal of Environmental Studies v3 n3 p223-7 (Jul 1972)

Accident research, Epidemiology, Accident prevention, Driver behavior research, Secondary collisions, Occupant protection, Pedestrian safety, Vehicle design, Highway design, Age factor in accidents, Injury prevention, Environmental factors

Accidental trauma in general and traffic accidents in particular are discussed briefly within the framework of the host (the accident victim), the agent (the vehicle), and the environment complex of conventional epidemiology. The rise of accidents is contrasted to the fall in infectious disease over the years, and some of the basic characteristics of traffic accidents are reviewed. Programs which aim at behavioral modification are unlikely to produce startling improvements in the short run. Similarly the economic restrictions on environmental changes would seem to inhibit radical benefits from being achieved in

Group 1C—Investigation And Records

the immediate future. Improvements in injury prevention rather than accident avoidance will have the greatest effect within the next few years. The emerging science of accident research is an important field of study which should be encouraged.
HS-013 283

THE MECHANICS OF VEHICLE COLLISIONS

H. Reizes 1973 148p
Book dealer

Accident reconstruction, Accident causes, Vehicle mechanics, Speed estimation from skidmarks, Impact forces, Rebound, Head on collisions, Vehicle vehicle interface, Moments of inertia, Coefficient of friction, Deformation analysis, Displacement, Momentum, Impact angle, Vehicle mass, Impact velocity, Accident analysis, Accident case reports, Side impact collisions, Vehicle center of gravity, Precrash phase, Crash phase, Postcrash phase, Vehicle weight, Accident diagrams, Deflection, Occupant Kinematics, Stopping distance, Braking forces, Braking time, Deceleration, Driver reaction time, Road grades, Road curves, Camber, Rollover accidents, Night driving, Mathematical analysis

The technical factors involved in the motion of vehicles and their collision are presented for the purpose of deriving accident reconstruction methods. The theory of axial collisions; the theoretical foundations of right angle and oblique collisions; and examples of parallel, head on, rectangular, and oblique collisions, and occupant kinematics are presented. The mechanics of braking on a straight road, on a grade, and in a curve; the causes of rollovers; and vehicle moments of inertia are outlined. The importance of driver reaction time in braking and night driving is emphasized.

HS-013 318

**DIFFERENT GENERAL SPEED LIMITS IN SWEDEN.
EFFECTS ON ROAD ACCIDENTS AND ON VEHICLE SPEEDS**

Statens Vag-och Trafikinstitut (Sweden), S43345
For primary bibliographic entry see Fld. 21.
HS-013 321

2. HIGHWAY SAFETY

**ROAD ACCIDENT STATISTICS--A COMPARISON OF
POLICE AND HOSPITAL INFORMATION**

J. P. Bull, B. J. Roberts 1973 2ref5
Accident Analysis and Prevention v5 n1 p45-53 (Apr 1973)

Accident statistics, Injury statistics, Accident records, Police reports, Hospital records, Reliability, Injury classification, Injury severity, Accuracy, Birmingham (England), Bicycle rider injuries, Unreported accidents

To explore the reliability of British accident statistics an analysis was made of a sample of 1,200 patients injured in road accidents and attending the hospital. These same cases were traced in the police records on which official statistics are based. All fatal cases were correctly notified but two types of discrepancy occurred among injuries. In a small number of cases, reclassification of serious and slight injuries seemed to be required. A more important discrepancy was that about one-sixth of serious injuries and one third of slight injuries known to the hospital did not appear in the police notifications. Inju-

ries to bicycle riders were particularly poorly notified. Less than one quarter of those known to the hospital appeared in the official statistics. It is concluded that similar comparisons of hospital and police information should be made elsewhere to confirm whether this sample is representative of the national rate of notification. In the meantime it is suggested that figures for injuries to bicycle riders and for slight injuries in general should be used with caution.

HS-013 294

2. HIGHWAY SAFETY**2D. Design And Construction****TRAFFIC SAFETY: PROBLEMS AND SOLUTIONS**

For primary bibliographic entry see Fld. 3D.
HS-013 281

TRAFFIC ACCIDENTS--A MODERN EPIDEMIC

For primary bibliographic entry see Fld. 1C.
HS-013 283

**THE IMPACT OF AUTOMOTIVE TRANSPORTATION
ON THE ENVIRONMENT AND LEGISLATIVE
MEASURES FOR ITS CONTROL: UNITED STATES
EXPERIENCE**

For primary bibliographic entry see Fld. 5F.
HS-013 286

2G. Meteorological Conditions

**THE BRADY ARRAY--A NEW BULK-EFFECT
HUMIDITY SENSOR**

Thunder Scientific Corp., T23450
P. F. Bennewitz 1973 8p Rept. No. SAI-730571
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Humidity, Semiconductors, Sensors, Measuring instruments, Measurement, Performance characteristics, Hysteresis, Accuracy, Signal conditioners, Solid state devices, Instrument sensitivity, Brady sensor

The Brady Array humidity sensor represents an advance in the state-of-the-art of moisture measurement, exhibiting characteristics of extremely small size, fast response, low hysteresis, and high accuracy. Stressed bonds within the structure initiate rapid recovery by purging the sensor when it is moved from higher to lower values of relative humidity. The sensing element is contained within a T0-5 type transistor housing, measuring only 10 mil in diameter and 100 mil in length. The array has been operated over temperature extremes ranging -200 to plus 800F without damage or loss of calibration. The technique employed in the array also lends itself to sensing of other gases. In-house development is in progress on array-type sensors of the major pollutants.

HS-013 250

**THE NEEDS OF COMMUNITIES AND LEGISLATION
OF THE ROAD TRANSPORT VEHICLE**

For primary bibliographic entry see Fld. 5F.
HS-013 284

THE IMPACT OF AUTOMOTIVE TRANSPORTATION ON THE ENVIRONMENT AND LEGISLATIVE MEASURES FOR ITS CONTROL: UNITED STATES EXPERIENCE

For primary bibliographic entry see Fld. 5F.
S-013 286

H. Police Traffic Services

INFORMATIONSIHÅMNING I KORSNINGAR. 4.

STUDIUM AV FÖRBÄTTERENDE SAMT

INTENSIFIERADE

LYCKSPÅLSUNDERSÖKNINGAR I Signalreglerade KORSNINGAR, GÖTEBORG 1970

For primary bibliographic entry see Fld. 3D.
S-013 298

I. Traffic Control

INFORMATIONSIHÅMNING I KORSNINGAR. 4.

STUDIUM AV FÖRBÄTTERENDE SAMT

INTENSIFIERADE

LYCKSPÅLSUNDERSÖKNINGAR I Signalreglerade KORSNINGAR, GÖTEBORG 1970

For primary bibliographic entry see Fld. 3D.
S-013 298

DIFFERENT GENERAL SPEED LIMITS IN SWEDEN. EFFECTS ON ROAD ACCIDENTS AND ON VEHICLE SPEEDS

Statens Vag-och Trafikinstitut (Sweden), S43345
O. Roosmark, G. Nilsson 1972 22p Rept. No. 19
Corporate author

Speed limits, Speed limit effectiveness, Sweden, Accident rates, Accident prevention, Regression analysis, Accident studies, Road width, Road shoulder width, Traffic volume, Road conditions, Day of week, Vehicle mileage, Speed differential, Accident costs, Travel time costs

Comparisons were made between the respective frequencies of accidents occurring on the same roads under the following conditions: a 90 km/h speed limit and no speed limit; a 110km/h speed limit and no speed limit; speed limits of 90 and 110km/h; and a 130 km/h speed limit and no speed limit. A 90 KM/H speed limit had a positive effect on the accident frequency as compared with the corresponding no speed limit periods. The reduction in the number of accidents was 25% for injury and 50% for property damage accidents. A comparison between a 90 km/h speed limit and no speed limit showed no statistical differences in accident frequency. Various comparisons between speed limits of 90 and 110 km/h indicated that the lower speed limit had a positive effect on the frequency of accidents. Insufficient data made it impossible to draw conclusions as to the effects of 130 km/h speed limits.
S-013 321

3. HUMAN FACTORS

3A. Alcohol

YOUTH, ALCOHOL, AND COLLISION INVOLVEMENT

R. Zylman 1973 69refs
Journal of Safety Research v5 n2 p58-72 (Jun) 1973)

Drinking drivers, Young adult drivers, Adolescent drivers, Age factor in driving, Age factor in accidents, Alcohol usage, Parent child relations, High risk drivers, Driver mileage, Accident risk forecasting, Blood alcohol levels, Time of day, Sociological factors, Accident rates, Chi square test

Only 2-6% of drivers aged 24 and younger are intemperate drinkers. Alcohol use varies according to geographic location, ethnic and religious background, and parental custom. Parents have greater influence than peer group on drinking habits. The small minority of youth who are problem drinkers also frequently exhibit other antisocial behavior. Young drivers are overrepresented in collision involvement; however, this overinvolvement is reduced by half when measures of exposure are used. Young drivers are not involved in more collisions because of alcohol use than older drivers; their collision involvement index is greater when nondrinkers alone are considered than when all drivers are included. Young drivers are particularly vulnerable to small amounts of alcohol. Youth are also overinvolved in fatal crashes, but this may not be attributable to alcohol.
HS-013 288

ALCOHOLISM AND DRIVING

C. J. Bridge 1972 91p 3refs
Book dealer

Alcoholism, Drinking drivers, Driver intoxication, Alcohol effects, Drinking driver evidence, Arrests, Driver records, Mental disorders, Behavior, Blood alcohol levels, Case reports, Drug effects, Rehabilitation, Problem drivers, Judgment, Mental deterioration, Psychological factors

Drunk driving arrest cases were utilized to study alcoholism's relationship to driving. In a random group of 200 cases, wherein it was determined that the arrested drivers were intoxicated, 173 were studied in some depth. On the Jellinek scale, using the known symptoms, all of the 173 cases fitted into either the crucial or chronic phases of alcoholism. Twenty-four of the 200 suspects admitted to drinking problems. The remaining suspects practiced much denial. This seemed to be the most prominent feature of the disease. Alcohol effects, from subtle losses of judgment to extreme deterioration, are correlated with driving characteristics. Possible means of improving the current drunk driving problem are considered. It is concluded that since alcoholism is not a readily treatable disease, especially without motivation, alcoholics must be kept off the road until there is a definite remission of the illness.
HS-013 319

3B. Anthropomorphic Data

HUMAN FACTORS INFLUENCING CONTROL POSITIONS

For primary bibliographic entry see Fld. 5D.
HS-013 313

Field 3—HUMAN FACTORS

Group 3D—Driver Behavior

3D. Driver Behavior

TRAFFIC SAFETY: PROBLEMS AND SOLUTIONS

J'E. Baerwald 1972 12 refs

International Journal of Environmental Studies v3 n3 p209-15 (Jul 1972)

Accident prevention, Precrash phase, Crash phase, Postcrash phase, Vehicle design, Highway design, Crashworthiness, Drinking drivers, Driver intoxication, Air bag restraint systems, Pedestrian safety, Vehicle safety standards, Experimental vehicles, Safety cars, Motorcycle safety, Motorcycle accidents, Head restraints, Fatality rates, Driver tests, International factors,

Accident prevention should emphasize precrash, crash, and postcrash phase countermeasures. Precrash phase countermeasures cover the development of driver education and improvement programs and tests of the driver's mental and physical ability to successfully operate a motor vehicle under most normal and emergency situations. Crash phase countermeasures involve development of crashworthy vehicles with improved occupant packaging. Postcrash phase countermeasures are primarily directed toward emergency signal generation and other communications, emergency transportation of the injured, emergency medical care, and debris removal. Motorcycle and pedestrian safety and highway design should also be stressed in accident prevention efforts. The Experimental Safety Vehicle Program is cited as an example of the type of international cooperation that should be expanded with participation by all nations.

HS-013 281

TRAFFIC ACCIDENTS—A MODERN EPIDEMIC

For primary bibliographic entry see Fld. 1C.

HS-013 283

YOUTH, ALCOHOL, AND COLLISION INVOLVEMENT

For primary bibliographic entry see Fld. 3A.

HS-013 288

SEAT BELTS: FACTORS INFLUENCING THEIR USE. A LITERATURE SURVEY

For primary bibliographic entry see Fld. 5N.

HS-013 293

NONFATAL TRAFFIC ACCIDENTS IN RELATION TO BIOGRAPHICAL, PSYCHOLOGICAL AND RELIGIOUS FACTORS

J. W. Kuzma, P. W. Dysinger, P. Strutz, D. Abbey 1973 7 refs
USPN-9R-01-EC-00177

Accident Analysis and Prevention v5 n1 p55-65 (Apr 1973)

Driver characteristics, Driver attitudes, Accident factors, Driver personality, Driver religious affiliation, Driver psychological tests, Driver attitude measurement, Accident rates, Traffic law violations, Driver records, Psychological factors, Driver mileage

Using a driver attitude survey instrument, 102 randomly selected Seventh Day Adventists (SDAs) were compared with their matched neighbor group. A number of demographic and driving habit variables were included in a separate questionnaire. It was shown that the two groups differed significantly in

only six psychological factors. The SDAs had a significantly lower mean score on alcoholic tendency, ambition, and masculinity, but a higher score on benevolence, friendliness, and objectivity. No significant differences were observed on accident attitude, violation attitude, general activity, and personal relations. With respect to the biographical variables, significant differences were observed between the two groups in such items as church attendance, Bible study, prayer, the drinking of alcoholic beverages, and military service experience. No differences were observed between the groups in driver exposure. In a study of the relationship of accident rates to various factors, military service experience, not reading the Bible, and drinking of alcohol turned out to be the most important.

HS-013 295

INFORMATIONSHAMTNING I KORSNINGAR. 4. STUDIER AV FORARBETENDEEN SAMT INTENSIFIERADE

OLYCKSPATISUNDERSOKNINGAR I Signalreglerade KORSNINGAR, GÖTEBORG 1970

S. O. Gunnarsson 1972 142p refs

Text in Swedish.

Chalmers Tekniska Högskola. Institutionen för Stadsbyggnad Meddelande n52 (1972)

Defensive driving, Driver behavior, Police traffic services, Signalized intersections, Speed changes, Braking, Data acquisition, Traffic signal violations, Traffic signal coordination, Traffic signal colors, Sweden, Traffic surveillance, Accident prevention

Results of an investigation into the effects of intensified police surveillance on driver behavior at signalized intersections indicate a change to more defensive driving. During periods of police supervision average speeds dropped 35 meters before the stop line for stopping drivers, who are directly affected by the signal change from green-amber to red, and for drivers who must stop because the signal shows red. Traffic signal violations dropped from 23 to 9.2% of the number of vehicles which were 40-100 meters from the stop line when the signals changed to green-amber. Periodic visible police supervision evenly distributed over different supervisable behavior patterns, traffic signal coordination, trials of optically programmed signals, which provide the road user with only the relevant information, and changing signals from the present green-amber phase to amber only are recommended.

HS-013 298

A MATHEMATICAL MODEL OF DRIVER ALERTNESS

F. A. Haight 1972 5 refs

Mathematical models, Hazard perception, Attention, Driver modeling, Driver behavior, Search performance, Accident avoidance, Poisson density functions, Risk taking

A ten parameter model is developed, relating to the experiences of a single driver in complex traffic; It is postulated that the driver observes the danger at time imperfectly, and that his instants of observation form a non-homogeneous Poisson process. The mean value of the process is functionally dependent on the most recent observed value. The driver is assumed to exercise a measure of control over the process by means of a braking function in which he chooses parameter values. After a reaction time has expired, he may employ the braking function

to modify the evolution of the process. The parameters chosen are also dependent on the most recent value of danger observed. A numerical example is given, as well as a discussion of possibilities for parameter calibration and estimation. The entire system is applicable to other control processes in which a subject attempts to choose parameters in a complex, imperfectly perceived, dynamic situation.
HS-013 299

THE MECHANICS OF VEHICLE COLLISIONS

For primary bibliographic entry see Fld. 1C.
HS-013 318

3E. Driver Education

AN EVALUATION INSTRUMENT TO MEASURE TEACHER EFFECTIVENESS IN DRIVING SIMULATION

D. O. Ritzel, J. E. Aaron 1973 8refs
Journal of Safety Research v5 n2 p82-9 (Jun 1973)

Driver education evaluation, Driving simulation, Instructors, Questionnaires

Effective and ineffective driving simulation teacher behaviors were identified from incidents reported by college instructors, high school teachers and supervisors, and high school students. The identified behaviors were classified into 17 subcategories of critical behaviors and this classification scheme verified by independent judges. An evaluation instrument for driving simulation teachers was designed, based on these behavioral subcategories. An observer reliability study conducted with the instrument yielded inter-observer reliability coefficients ranging from .93 to .98.
HS-013 289

4. OTHER SAFETY-RELATED AREAS

4A. Codes And Laws

LEGISLATION AND THE MOTOR CAR

For primary bibliographic entry see Fld. 5D.
HS-013 285

THE IMPACT OF AUTOMOTIVE TRANSPORTATION ON THE ENVIRONMENT AND LEGISLATIVE MEASURES FOR ITS CONTROL: UNITED STATES EXPERIENCE

For primary bibliographic entry see Fld. 5F.
HS-013 286

4B. Community Support

SEAT BELTS: FACTORS INFLUENCING THEIR USE. A LITERATURE SURVEY

For primary bibliographic entry see Fld. 5N.
HS-013 293

THE EFFECT OF A DANISH PROPAGANDA CAMPAIGN FOR CHILDREN TO BE PLACED IN THE BACK SEAT OF CARS. RESEARCH NOTE

For primary bibliographic entry see Fld. 5N.
HS-013 296

4C. Cost Effectiveness

LEGISLATION AND THE MOTOR CAR

For primary bibliographic entry see Fld. 5D.
HS-013 285

4E. Information Technology

ACCELERATED FATIGUE-TESTING IMPROVEMENTS—FROM ROAD TO LABORATORY

For primary bibliographic entry see Fld. 5D.
HS-013 244

THE CHALLENGE OF AUTOMOBILE DESIGN FOR THE 1970'S

For primary bibliographic entry see Fld. 5D.
HS-013 301

4G. Mathematical Sciences

SENSOR FOR ON-VEHICLE DETECTION OF ENGINE EXHAUST GAS COMPOSITION

General Motors Corp., G06600
For primary bibliographic entry see Fld. 5F.
HS-013 254

TECHNIQUES AND EQUIPMENT FOR AXIAL FATIGUE TESTING OF SHEET STEEL

Dominion Foundries and Steel Ltd. (Canada), D21450; Waterloo Univ. (Canada) W09000
For primary bibliographic entry see Fld. 5D.
HS-013 257

FAULT-TREE APPLICATIONS TO THE AUTOMOBILE INDUSTRY

Booz-Allen Applied Res., Inc., B20400
For primary bibliographic entry see Fld. 5D.
HS-013 265

ON THE OCCUPANT CRASH PROTECTION SYSTEM OF THE NISSAN ESX

Nissan Motor Co Ltd. (Japan), N60600
For primary bibliographic entry see Fld. 5D.
HS-013 266

HANDLING AND STABILITY. VOLVO'S EXPERIMENTAL SAFETY CAR

Volvo A.B. (Sweden), V17400
For primary bibliographic entry see Fld. 5R.
HS-013 267

STUDY OF THE DEACTIVATION OF BASE METAL OXIDE OXIDATION CATALYST FOR VEHICLE EMISSION CONTROL

Ford Motor Co., F18600
For primary bibliographic entry see Fld. 5F.
HS-013 269

INTERACTION DYNAMICS OF AN INFLATING AIR BAG AND A STANDING CHILD

Ford Motor Co., F18600
For primary bibliographic entry see Fld. 5O.
HS-013 275

Field 4—OTHER SAFETY-RELATED AREAS

Group 4G—Mathematical Sciences

THE DESIGN OF HYBRID CUSHION CARS

For primary bibliographic entry see Fld. 5N.
HS-013 282

ESTIMATING THE EFFECTS OF CRASH PHASE INJURY COUNTERMEASURES--2. THE FATALITY TREND AND ITS MODIFICATION BY COUNTERMEASURES.

For primary bibliographic entry see Fld. 1B.
HS-013 292

A MATHEMATICAL MODEL OF DRIVER ALERTNESS

For primary bibliographic entry see Fld. 3D.
HS-013 299

THE REALISM OF VEHICLE IMPACT TESTING

For primary bibliographic entry see Fld. 5D.
HS-013 302

THE EFFECTS ON BODY STRUCTURES OF PRESENT AND POSSIBLE FUTURE SAFETY LEGISLATION, AND THE MATHEMATICAL SIMULATION OF BARRIER IMPACT

For primary bibliographic entry see Fld. 5D.
HS-013 303

STRUCTURAL ANALYSIS OF CAR BODY SHELLS USING COMPUTER TECHNIQUES

For primary bibliographic entry see Fld. 5D.
HS-013 308

THE STRUCTURAL DESIGN OF BUS BODIES

For primary bibliographic entry see Fld. 5B.
HS-013 310

MODERN METHODS OF TRANSLATING A STYLING MODEL TO A BODY DRAFT AND TOOLING

For primary bibliographic entry see Fld. 5D.
HS-013 317

THE MECHANICS OF VEHICLE COLLISIONS

For primary bibliographic entry see Fld. 1C.
HS-013 318

POSSIBLE IMPROVEMENTS IN RIDE COMFORT

For primary bibliographic entry see Fld. 5D.
HS-013 322

ON THE DESTABILIZING EFFECT OF LIQUIDS IN VARIOUS VEHICLES, PT. 2

For primary bibliographic entry see Fld. 5R.
HS-013 323

4H. Transportation Systems

ON ASSESSING THE ENVIRONMENTAL IMPACT OF URBAN ROAD TRAFFIC

F. E. Joyce, H. E. Williams 1972 36refs
International Journal of Environmental Studies v3 n3 n201-7 (Int

HSL 73, No. 20

Urban highways, Transportation planning, Environmental planning, Environmental factors, Environmental quality, Highway environmental impact, Traffic noise, Pedestrian traffic flow, Pedestrian safety, Visibility, Vehicle air pollution, United Kingdom, Secondary roads, Highway planning

The objectives of urban transportation plans are increasingly being framed in environmental terms. This has resulted in part from the knowledge that the transportation system can be manipulated to achieve desirable patterns of urban development and in the more negative sense from growing awareness of the disamenity that stems from urban road traffic. Discussion is restricted to the physical environmental impact of road traffic in terms of noise, pedestrian delay and hazard, visual intrusion, severance, and atmospheric pollution. Recent research in the United Kingdom is examined. Special attention is drawn towards the planning problems that will result from increasing traffic on secondary and local roads. Problems presented by the lack of a comprehensive evaluative framework for seeking environmental goals are dealt with and the use of some interim measures are recommended.
HS-013 280

5. VEHICLE SAFETY

5A. Brake Systems

THE MECHANICS OF VEHICLE COLLISIONS

For primary bibliographic entry see Fld. 1C.
HS-013 318

5B. Buses, School Buses, And Multipurpose Passenger Vehicles

1973 MOTOR TRUCK FACTS

111973 1275P REFS

Corporate author 1619 Massachusetts Ave., N. W. Washington, D. C. 20036

Transportation statistics, Production statistics, Sale statistics, Truck sales, Bus sales, Trucking industry, Motor carriers, Exhaust emission control, Recreational vehicles, Noise control, Vehicle registration, Vehicle age, Vehicle registration by model year, Trucks, Buses, Freight transportation, Vehicle mileage, School buses, Truck usage, Fleets, Economic factors, Imports, Exports, Taxation, Government vehicles, Employment

Truck and bus production, registration, usage, and ownership information are presented, and the economic impact of the trucking industry is discussed. Statistics are provided for production, sales, registration, usage, mileage, ownership, taxes, vehicle age, imports, exports, freight tonnage shipped, and employment provided by the truck and bus industries. Annual production and sales records for trucks and buses set in 1971 were surpassed in 1972 with 2,482,574 units produced and sales reached 2,533,918 units. Spurred by increased use for personal transportation and recreation, light trucks moved up to account for 84% of factory sales in 1972 and with those under 6,000 pounds gross vehicle weight accounting for 58% of all truck sales. Nearly 9.8 million U. S. households own light trucks. Trucks continued as the prime mover of manufacturers' freight shipments between cities handling 51% of such tonnage and freight movement over U. S. highways accounted for 7.6% of the Gross National Product.

Steam buses, Rankine cycle engines, Surveys, Public opinion, Passengers, Bus drivers, Consumer acceptance, Passenger characteristics, Occupation, Trip frequencies, Racial factors, Age factors, Sex factors, Bus design, Vehicle performance, Exhaust odors, Smoke, Smog, Exhaust emissions, Vehicle noise, Air pollution sources, Air pollution control, Benefit cost analysis, Attitude measurement, Questionnaires, Diesel engines, California, Federal role

Rankine cycle external combustion engines were installed on three conventional buses, replacing the original diesel engines. Passengers are surveyed on both conventional diesel and modified steam buses. Characteristics of the survey samples and methodology are described. The findings revealed a high public concern for the problems of air pollution and an overwhelmingly favorable response to the steam buses. The survey of transit managers focused on the role of steam bus technology as an attractive anti-pollution measure. Three-fourths of the transit managers were ambivalent or unwilling to pay a higher premium for steam buses. In-depth personal interviews sales conducted with five operators of both diesel and steam buses. Comfort, operating, and general attitude factors were stressed. Findings are presented with reference to quietness, smoothness, power, odor, smoke, safety, pollution, handling, operation, and passengers' reactions. All five drivers expressed a preference for the steam bus.
HS-013 291

THE STRUCTURAL DESIGN OF BUS BODIES

G. H. Tidbury 1970 12refs Rept. No. Paper-9
Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Structural design, Bus design, Structural analysis, Stress analysis, Bending, Torsion, Stiffness, Great Britain, Load profile analysis, Deflection, Flexibility, Loads (forces), Bodies, Chassis, Models, Computerized simulation, Model tests

The problems of designing bus and coach bodies are discussed. The matching of the body structure and chassis frame causes problems which have been largely overcome on an ad-hoc basis. Simple theoretical methods are suggested for estimating the stiffness in bending and torsion of the superstructure of composite buses. The formulae are checked against computer analyses and plastic models when possible. The proportion of load carried by the bodywork is estimated to find the stresses in critical members for any combined loading. Although further analysis and full-scale testing are required, preliminary design calculations for composite buses can be based on this method.
HS-013 310

5D. Design

ACCELERATED FATIGUE-TESTING IMPROVEMENTS—FROM ROAD TO LABORATORY

D. Hollinger, A. Mueller 1973 12p 1ref Rept. No. SAE-730564
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

A technique for programming accelerated laboratory fatigue tests which is called the 'peak-valley-pair' (P-V-P) method is described. As presented, the P-V-P METHOD applies to automotive structural components which are insensitive to frequency and subjected to unidirectional loading. The P-V-P algorithm operates on the measured service responses of the component (displacement, load, strain, etc.) to yield the control signal for a laboratory fatigue test; Associated data processing and an example of this methodology are also presented.
HS-013 244

SHORTCUTS IN CUMULATIVE DAMAGE ANALYSIS

Stanford Univ., S38400
H. O. Fuchs, D. V. Nelson, M. A. Burke, T. L. Toomay 1973
25p 13refs Rept. No. SAE-730565
Presented at Automobile Engineering Meeting, Detroit, 13-18 May 1973. Includes 'Computation of Ordered Overall Ranges' by T. L. Toomay.
SAE

Damage estimation, Loads (forces), Fatigue (materials), Stress (mechanics), Strain (mechanics), Stress strain characteristics, Forecasting, Fatigue life, Computer printouts, Flow charts, Computer programs, Fortran,

A method for shorter evaluation of the fatigue damage done by an irregular sequence of loads is presented. The method looks first for the largest overall range from highest peak to lowest valley, then for the next largest overall range that interrupts the first range, and so on, down until a suitable fraction (for example, 10%) of all reversals have been used. These few reversals form a short history, which will do substantially the same damage as the total history. The process is applied to three long histories. The sensitivity of calculated damage to the omission of smaller ranges is computed for plain and for notched specimens. The error is compared with differences produced by different current rules for evaluating damage, by different cycle counting methods, and by smooth specimen simulation of notched parts.
HS-013 245

SEMICONDUCTOR SENSORS FOR AUTOMOTIVE INSTRUMENTATION

I. C. Transducers, Inc., 100200
K. N. Sundaram 1973 8p 5refs Rept. No. SAE-730572
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Semiconductors, Sensors, Pressure transducers, Seals, Silicon, Corrosion prevention, Corrosion inhibitors, Coatings, Switches, Temperature, Voltage regulation

Piezoresistive phenomena found in silicon semiconductors and the possibility it has of integrating various electronic functions are a viable method of meeting future automotive requirements. The evolution of semiconductor sensors is discussed. A pressure transducer has been designed with a regulator sensitivity compensation and offset balancing network which are integrated into a single chip. An integrated sensor can be used for pressure measurements of manifold vacuum, engine oil, and

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brake line. Partial integration of simple electronic functions such as a regulator for 12V battery operation has taken place. Semiconductor pressure transducers have limitations such as pressure ranging and temperature dependency. Methods of passivating sensors have improved the sensor capability to come into contact with petroleum products used in automobiles. Some circuits have been proposed which can be integrated with the sensor chip. Development of circuits for integration of electronic functions such as comparator, amplifier, and A to D converter is proposed.

HS-013 251

AUTOMOTIVE POWERPLANT TRANSDUCERS—FACT OR FICTION?

General Motors Corp., G06600
H. R. Mitchell, R. N. McGill 1973 7p 5refs Rept. No. SAE-730573
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Transducers, Sensors, Pressure transducers, Specifications, Performance characteristics, Automotive engineering, Control equipment

Most transducers offered commercially are suitable for laboratory, aerospace, or industrial process applications but do not need additional, stringent automotive requirements. A need exists, both present and future, for various types of transducers in automotive powerplant control systems. Possible electronic systems and subsystems requiring transducers are discussed, and the types of transducers needed for these systems are described along with a discussion of a general set of specifications with respect to accuracy, reliability, and durability. Substantial transducer development is needed to enhance the advancement of certain automotive electronic systems.

HS-013 252

PRECISION VACUUM PRESSURE TRANSDUCERS AT LOW COST

Gulton Industries, Inc., G31800
D. Payne 1973 6p Rept. No. SAE-730574
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Pressure transducers, Costs, Performance characteristics, Construction, Design, Vacuum operated equipment

Operation, construction, and performance of the Gulton Model GS-1 pressure transducer, which was designed primarily for automobile installation, are outlined. Considerations in the transducer's development included corrosive or solvent characteristics of the pressure media commonly encountered in the automobile engine compartment; vibration and shock levels; electromagnetic interference constraints; temperature variations; calendar and cycle life; electrical power available; size and weight; mounting, including pneumatic and electrical connection; and cost. These factors have been accommodated without compromising accuracy. The Model GS-1 transducer can be sold at prices as low as \$5.00.

HS-013 253

TRANSDUCERS FOR ENGINE MANAGEMENT

Lucas (Joseph), (Electrical) Co. Ltd. (England) L24000
M. M. Bertoli 1973 10p 4refs Rept. No. SAE-730576

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Transducers, Detectors, Electronic devices, Throttle angle, Crank angle, Air flow, Fuel flow, Metering, Potentiometers, Engine speeds, Flowmeters, Exhaust composition, Exhaust emission measurement, Engine operating conditions, Electronic fuel injection, Electronic ignition systems

The particular difficulties encountered in designing fuel and ignition control in today's automobiles have led to consideration of electronic systems. These are totally dependent upon the transducers used to provide the information they require, and frequently the success of a given system depends upon the solution of some transducer problem. Some of the alternative choices of input parameters to a control system intended to manage the fuel and ignition of an internal combustion engine are discussed. The requirements for, and designs for, transducers to measure throttle angle, crankshaft speed and position, air mass flow, engine component position, and exhaust quality are discussed.

HS-013 255

A SOLID-STATE STRAIN GAGE VACUUM SENSOR

Bell and Howell Co., B06760
R. L. Cheney 1973 7p 2refs Rept. No. SAE-730577
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Strain gages, Semiconductors, Pressure transducers, Vacuum gauges, Sensors, Stability, Silicon, Bonding, Manufacturing, Performance tests, Calibration, Temperature endurance tests, Transducers

Diffused semiconductor strain gauge pressure transducer elements provide excellent long-term sensor stability. A unique glass-to-silicon bonding method enables a vacuum sensor to be constructed without degrading this basic stability, and computer-aided test and adjustment of each sensor provides outstanding performance over a broad temperature range and unit-to-unit interchangeability. This system was designed for use as a manifold vacuum sensor in electronic ignition and electronic fuel injection systems.

HS-013 256

TECHNIQUES AND EQUIPMENT FOR AXIAL FATIGUE TESTING OF SHEET STEEL

Dominion Foundries and Steel Ltd. (Canada), D21450; Waterloo Univ. (Canada) W09000
G. M. Marsh, A. D. Robb, T. H. Topper 1973 11p 3refs Rept. No. SAE-730578
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Fatigue tests, Test equipment, Steels, Sheet metal, Strain (mechanics), Fatigue life, Strain gauges, Calibration, Performance characteristics, Mathematical analysis, Stress (mechanics), Extensometers

A specimen gripping and alignment device, and an inexpensive, highly sensitive diametral extensometer were developed in order to characterize the fatigue behavior of sheet steels ranging in thickness from 0.10-0.20 in. Test results indicate that the combination of specimen geometry and specially designed grips

performed satisfactorily, and that longitudinal and diametral specimens are satisfactory for strain amplitudes up to 0.75 and 7%, respectively. The techniques could be used to obtain axial fatigue data on sheet steel as thin as 0.100 in;
HS-013 257

FAILURE ANALYSIS OF A SHOT-PEENED

COMPONENT

IIT Res. Inst., 106000; Naval Air Devel. Center, N31800
O. Johari, W. A. Sipes 1973 11p 1ref Rept. No. SAE-730579
Contract NAS1-10788
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973. This work was first submitted as NASA-CR-2166, dt Jan. 1973.
SAE

Fatigue (materials), Fractures, Shot peening, Landing gear, Scanning electron microscopes, Failures, Pistons, Photographs, Fracture mechanics, Analysis

A comprehensive scanning electron microscope (SEM) survey of the fracture surfaces of an aircraft main landing gear shock strut piston showed that improper shot peening contributed to the initiation of the anomalous fatigue failure. SEM photographs of the suspect-origin regions and the surrounding areas were analyzed. The photographs are presented, along with a detailed description of the regions observed. Failure mechanism is discussed, and causes of fracture origin explored.
HS-013 258

THE ROLE OF SURFACE FINISH IN PITTING FATIGUE OF CARBURIZED STEEL

Pucker Engineering Associates, P00550; IIT Res. Inst., 106000
J. J. P. Sheehan M. A. H. 1973 24P 4REFS Rept. No. SAE-730580
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Surface roughness, Pitting, Fatigue (materials), Steels, Carburizing, Fatigue tests, Test equipment, Grinding, Polishing, Honing, Microstructure, Hardness, Photomicrography, Profile measurement, Lubricating oils, Viscosity, Fatigue life, Spalling, Cracking, Films (coatings), Load bearing capacity, Corrosion resistance, Corrosion inhibitors, S-N diagrams

Results of an investigation of the influence of surface roughness of lubricated rolling-sliding contact surfaces on pitting fatigue indicate that a significant increase in pitting resistance results from polishing the ground mating surfaces. When the roughness of the loading rollers (positive slip element) and that of the test specimen (negative slip element) was reduced there was a gain of about 150% in load carrying capacity before pitting occurred. The surface roughness of the loading roller appears to be the dominating factor. The degree of metallic contact and surface distress decreases when the roughness of the roller approaches the thickness of the oil film.
HS-013 259

IMPROVED AUTOMOBILES THROUGH PRODUCT DEVELOPMENT

Chrysler Corp., C42600
R. R. Love, C. W. Ewing 1973 12p 11refs Rept. No. SAE-730585
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973;
SAE

Automotive engineering, Automobile design, Automobile comparisons, Proving ground tests, Test tracks, Road tests, Wind tunnels, Proving grounds, Impact sleds, Impact tests, Barriers, Automobile dimensions, Body design, Engine design, Transmission design, Brake design, Electric system design, Automobile maintenance, Plymouths, Chrysler Corp.

A comparison of the dimensions, body construction and suspension isolation, engine, transmission, brakes, electrical system, maintenance items and schedules, and standard equipment is presented for a 1958 Plymouth Belvedere versus a 1973 Plymouth Fury 3 in order to highlight design improvements. Emphasis is placed upon the role of testing in new model development, and the Chrysler Corp. Proving Grounds facilities, including the test track, roads, grades, splash trough, test circle, wind tunnel, vehicle dynamics facility, impact simulator laboratory, and impact barrier, are described.
HS-013 263

FAULT-TREE APPLICATIONS TO THE AUTOMOBILE INDUSTRY

Booz-Allen Applied Res., Inc., B20400
J. Mateyka, R. Danzeisen, D. W. Weiss 1973 12p 4refs Rept. No. SAE-730587
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Failures, Automotive engineering, Automobile design, Defective vehicles, Diagnosis, Accident investigation, Safety design, Accident causes, Multidisciplinary teams, Vehicle inspection, Fault, Reliability

A fault tree is a logic diagram that develops all of the subsystem and component faults and combinations of faults which can result in particular system symptoms or faults. This type of logic diagram can be used as a reliability tool for identifying and cataloging specific problems, to preclude their being incorporated in new designs; as a diagnostic aid to maintenance personnel in systematically screening potential vehicle performance problems; and as an aid in assessing accident causation factors and the potential contribution of vehicle defects to accidents. The value of such logic diagrams over conventional troubleshooting charts and manuals in aiding mechanics to pinpoint specific problems is emphasized.
HS-013 265

ON THE OCCUPANT CRASH PROTECTION SYSTEM OF THE NISSAN ESV

Nissan Motor Co. Ltd. (Japan), N60600
T. Maeda, N. Irie, S. Sato 1973 16p 1refs Rept. No. SAE-730589
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Occupant protection, Safety cars, Experimental automobiles, Crashworthiness, Air bag restraint systems, Crashworthy bodies, Energy absorption, Occupant kinetics, Automobile design, Crash phase, Impact forces, Computerized simulation, Mathematical models, Deceleration, Head on impact tests, Rear end impact tests, Automobile dimensions, Rear end collisions, Compact automobiles, Front seat passengers, Rear seat passengers, Nissan Motor Co. Ltd. (Japan), Japan

The Nissan experimental safety vehicle (ESV) has been developed with the intention that its dimensions should be

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based on those of small cars, and that its body construction should be nearly the same as that of small cars currently manufactured. The body construction and occupant protection system of the Nissan ESV, designed with a systematic approach and method of matching the body crashworthiness and the occupant protection system are discussed. The vehicle body is strengthened so as to absorb the impact energy in a collision and secure the occupant survival space. In order to use as much ride-down as possible, the occupant protection system is designed to decelerate the occupant in the initial phase of the crash. Therefore, a fast deployable air bag system was developed with operates within 25 ms after a collision, and the crush stroke at the front end is set at 850 mm. Satisfactory results have been obtained from collision tests.

HS-013 266

SHELL KRATON G THERMOPLASTIC RUBBER

Shell Chemical Corp., S14400

L. E. Gunnerson 1973 4p Rept. No. SAE-730599

Presented at Automobile Engineering Conference, Detroit, 14-18 May 1973.

SAE

Automobile materials, Thermoplastics, Rubber, Polymers, Physical properties, Chemical properties, Mechanical properties, Durability, Materials tests, Ozone, Weather resistance, Compression tests, Thermal factors

The chemical and physical properties of Kraton G compounds, a three-block polymer are outlined. The properties of the new product include excellent ozone resistance, good ultraviolet resistance, a broad range of service temperatures, excellent oxidative stability, and good compression set. The advantages offered include a more rubbery quality at minus 20F, easier processing, easier painting, and greater heat stability. The compound is applicable to exterior impact resistance parts, soft interior decorative parts, and general molded and mechanical parts of automotive vehicles; The better impact properties and lower raw material cost give Kraton G an edge over other automotive materials such as vinyl and polyurethane.

HS-013 271

TPR THERMOPLASTIC RUBBER

Uniroyal, Inc., U02500

J. R. Johnson, H. L. Morris 1973 12p 2refs Rept. No.

SAE-730600

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Thermoplastics, Rubber, Automobile materials, Polymers, Physical properties, Mechanical properties, Thermal factors, Heat resistance, Weather resistance, Fire resistant materials, Electric properties, Rheological properties, Molding, Extruding, Vinyl resins, Polyurethanes, Ethylene propylene terpolymer, Tensile strength, Viscosity, Hardness, Compression, Elongation,

A new family of thermoplastic rubbers with potential in a wide variety of automotive applications has been developed. They can be injection molded or extruded on conventional thermoplastic equipment into finished parts having the properties of vulcanized rubber. Salient features of TPR thermoplastic rubbers include fast molding cycles, reprocessability of scrap, exceptionally wide service temperature range (minus 60 to 300F), excellent environmental resistance and colorability, inherently

slow burning, excellent electrical properties and chemical resistance, and low elongation and compression set properties. The basic polymer properties and processing characteristics of TPR which are significant in determining automotive areas of applicability are presented. Potential automotive applications include exterior soft front and rear-end components, grommets, gaskets, bushings, seals, weatherstripping, and soft trim. TPR is compared with vinyl, polyurethane elastomer, and ethylene propylene terpolymer.

HS-013 272

THERMOPLASTIC POLYURETHANE ELASTOMERS. TEMPERATURE DEPENDENCE OF PHYSICAL PROPERTIES

Union Carbide Corp., U01800

F. E. Critchfield, J. V. Koleske, C. G. Seefried, Jr. 1973 12p

12refs Rept. No. SAE-730602

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Thermoplastics, Elastomers, Physical properties, Tensile strength, Molecular weight, Shear modulus, Stress (mechanics), Elongation, Thermal factors, Urethanes

Thermoplastic urethanes can be regarded as linear, block copolymers of the (AB)_n type, the A block being considered the soft segment and the B block the hard segment. This study was concerned with the temperature dependence of mechanical properties for thermoplastic urethanes based on polycaprolactone diols, 4, 4-diphenylmethane diisocyanate (MDI) and 1,4-butanediol (BDO). The molecular weight of the polycaprolactone diol (A or soft segment) was varied independently, as was the relative concentration of the MDI/BDO hard (B) segment. The resulting urethanes ranged from rubbery to hard and tough materials. Some of the urethanes displayed compatible behavior. Others displayed an incompatible behavior and were, thus, less temperature dependent.

HS-013 273

SOME ANALYTICAL CRASHWORTHINESS STUDIES OF AUTOMOBILE FRONT STRUCTURES

Calspan Corp., C23600

R. Shieh 1973 19p 16refs Rept. No. SAE-730612

Contract FH-11-7622

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Front structures, Crashworthiness, Dynamic structural analysis, Computerized simulation, Crash response forecasting, Structural deformation analysis, Matrix reduction, Finite element method, Collision models, Frame tests, Computer programs, Equations of motion, Elasticity, Plasticity, Pole impact tests, Deceleration, Displacement, Deflection, Mathematical analysis, Impact angle, Kinetic energy, Impact velocity

The dynamic response of a Model 2D2 automobile colliding into a narrow rigid pole obstacle or massive flat barrier at various collision speeds and the optimization problem of a car front frame structure were studied based on the matrix displacement method of frame analysis. The displacement and deceleration results for the 14.3 mph Model 2D2-pole collision case and 19.25 mph Model 2D2-flat barrier collision case were shown to correlate reasonably well with the results of full-scale tests. Although the study was confined to a special type of automo-

October 31, 1973

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bile front structures of the frame type, the computer program LDDAFS II may also be used to obtain the firsthand information for the structural collision response of chassis-body type automobiles.

HS-013 277

TRAFFIC SAFETY: PROBLEMS AND SOLUTIONS

For primary bibliographic entry see Fld. 3D.

HS-013 281

TRAFFIC ACCIDENTS—A MODERN EPIDEMIC

For primary bibliographic entry see Fld. 1C.

HS-013 283

LEGISLATION AND THE MOTOR CAR

H. J. C. Weighell 1972

International Journal of Environmental Studies 3v n3 p237-42 (Jul 1972)

Vehicle laws, Safety laws, Vehicle safety standards, Vehicle design, Safety design, Occupant protection, Air bag restraint systems, Exhaust emission control, Exhaust emission standards, Benefit cost analysis, International factors, Safety standards compliance, Standardization, Europe, United States, Government industry cooperation

Vehicle safety and emission control legislation is led by the United States where half the world's cars and one-third of the world's road deaths are found. The 1975/6 standards will cause confrontations between industry and government in the U. S. and have costly implications for the American people. The rest of the world is affected by what happens in the U. S. but for language and other reasons fragmented laws and conflicting manufacturing standards are normal. The greatest force for uniform legislation may be the enlarged Common Market which includes the four major European car manufacturing countries. Type approval is the vehicle safety standard compliance system used in Europe, but the growth in scope of safety and other legislation is bringing into focus a weakness of the system which is reducing production efficiency. American style self-certification is not acceptable to European governments.

HS-013 285

BODY ENGINEERING

111970 12

A symposium arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London, Includes HS-013 301--HS-013 317.

Institution of Mechanical Engineers Proceedings v184 pt3M (1969-70)

Automobile design, Impact tests, Body design, Automobile modeling, Plastics, Windshield design, Door design, Structural analysis, Automobile bodies, Computerized design, Structural design, Bus design, Automobile interior design, Frame design, Human factors engineering, Body tests, Vibration analysis, Noise control

Discussions and papers are presented on: the realism of vehicle impact testing; the effects of safety legislation on body structures, and the mathematical simulation of barrier impact; study of impact behavior using geometrically similar models; the all-plastic automobile: windshields: body components: computer

automotive design for safety interiors; chassis frames; human factors influencing control positions; automobile body testing techniques; experimental investigation of body structural vibration; sound damping control of automobile body structures; and modern methods of translating a styling model to a body draft and tooling.

HS-013 300

THE CHALLENGE OF AUTOMOBILE DESIGN FOR THE 1970'S

C. M. MacKichan 1970

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.

IN HS-013 300

Automobile design, Automotive industry, Automobile interior design, Serviceability, Computerized design, Computerized simulation, Design standards

Problems outside aesthetics which face the designer in the 1970's are outlined. Designers are subject to the criteria of safety, serviceability, assembly, and suitability of materials, in addition to competitiveness in terms of appearance. Some of the advanced tools being developed, which will make the designer's job more efficient are discussed. Computer Aided Design and Numerical Control Effort (CADENCE), is a computerized system which consists of a dynamic sketch pad and a light pen with which the designer can draw. With this new tool, the designer can call up information concerning his car design on a console before him. He can then transpose it, move it, or originate information which goes into the computer to add to the body of knowledge about this particular car design. This system will enable the designer to take into consideration all the many engineering inputs and all of the restrictive constraints placed upon the design, and will reduce the time between statement of a design and its execution.

HS-013 301

THE REALISM OF VEHICLE IMPACT TESTING

C. R. Ennos 1970 9refs Rept. No. Paper-1

Presented at a symposium entitled Body Engineering arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.

IN HS-013 300

Vehicle vehicle impact tests, Barrier collision tests, Head on impact tests, Rear end impact tests, Side impact tests, Anthropometric dummies, Impact angle, Transducers, Test equipment, Accelerometers, Deceleration detection, Impact velocity, Deformation, Impact forces, Vehicle mass, Seat design, Seat backs, Front seats, Head restraints, Displacement, Occupant protection, Door design, Passenger compartments, Occupant kinematics, Stiffness, Crashworthy bodies, Vehicle safety standards, Mathematical analysis, Angle impact tests

A comparison of barrier collision and vehicle vehicle impact tests indicates that front and rear impacts can be simulated by static barriers but side impacts are much more difficult because of the difficulty in obtaining clear and repeatable data from the complex motions involved in side impacts. Side impact tests using a mobile barrier are most effective for measuring door strength. Occupant protection could be improved by side stiffening of the body structure, improved head restraint design, and elimination of yielding front seat backs. Impact tests were

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HS-013 302

THE EFFECTS ON BODY STRUCTURES OF PRESENT AND POSSIBLE FUTURE SAFETY LEGISLATION, AND THE MATHEMATICAL SIMULATION OF BARRIER IMPACT

J. Curtis 1970 4refs Rept. No. Paper-2

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
IN HS-013 300

Body design, Vehicle safety standards, Design standards, Barrier collision tests, Mathematical models, Computerized simulation, Deceleration tolerances, Crush distance, Secondary collisions, Impact forces, Rear end impact tests, Fuel tank location, Side impact tests, Crashworthy bodies, Head on impact tests, Forecasting, Safety design, Occupant protection, Equations of motion

Vehicle performance in head on barrier collision tests is presently the most important of the requirements of safety legislation as far as body structures are concerned, and is likely to remain so in the future. Because the necessary testing of prototypes is expensive, a computerized simulation of head on, rear end, and side impact tests, based on empirical data from static crush tests and the equations of motion has been developed. Future safety legislation will emphasize increased occupant protection possibly by raising the test speed for head on barrier collisions, setting minimum deformation standards for the side of the vehicle, and requiring the fuel tank to be moved forward or the rear end of the vehicle to be extended.
HS-013 303

A STUDY OF IMPACT BEHAVIOUR THROUGH THE USE OF GEOMETRICALLY SIMILAR MODELS

G. W. Barley, B. Mills 1970 10refs Rept. No. Paper-3

Project sponsored by Rootes Motor Ltd. Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and Advanced School of Automotive Engineering, London.
IN HS-013 300

Scale models, Automobile modeling, Crash response forecasting, Front end impact tests, Model tests, Structural deformation analysis, Equations of motion, Test equipment, Cylinders, Impact sleds, Crush distance, Deceleration

A rigorous analysis of vehicle impact behavior is a very difficult task. The use of models and testing of simple structures can provide a basis for predicting the performance of complex structures. The behavior of motor vehicles in frontal impacts was investigated through the use of geometrically similar models. A large number of thin-walled cylinders were impact tested to establish scaling criteria and it was concluded that these models could be usefully employed in predicting full size vehicle behavior. A linear accelerator capable of accelerating a 1,000 lb. mass to 44ft/s, developed in order to test half-scale vehicle front ends, is described.
HS-013 304

TOWARDS THE ALL-PLASTICS MOTOR CAR

G. O. Gurney 1970 Rept. No. Paper-4

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Design, London.
IN HS-013 300

Plastics, Automobile bodies, Automobile materials, Molding, Casting, Polypropylene, Nylon, Glass fiber reinforced plastics, Polyurethanes, Economic factors, Automobile manufacturing

Since raw materials for steel are becoming more scarce, the use of plastics for automobile body structures could provide a desirable and necessary alternative to manufacturing cost savings; superior component performance at no extra cost; weight savings; and a specific performance when no other material would suffice. The various plastic production processes— injection molding, compression molding, blow molding, rotational casting, vacuum forming, and injection casting—are described and advantages and disadvantages of each process are listed. Present day materials suitable for automobile body and trim manufacture include polypropylenes, acrylonitrile-butadiene-styrene, glass fiber reinforced plastics, and polyurethanes. Properties, applications, and best manufacturing process for each material are given. Sufficient information now available from many sources proves that the economics is favorable for medium production runs of plastic bodies, at volumes around 1000 per week.
HS-013 305

STRUCTURAL ANALYSIS OF CAR BODY SHELLS USING COMPUTER TECHNIQUES

G. G. Moore 1970 6refs Rept. No. Paper-7

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
IN HS-013 300

Structural analysis, Automobile bodies, Computer programs, Computerized design, Equations of equilibrium, Body design, Stiffness, Beam tests, Stress analysis, Torsion

To predict as many characteristics as possible of projected body designs, a computer program has been developed on the basis of idealized beam and panel layouts. Results correlate well with actual tests but complete optimization is impossible because of the complexity of the structure and the number of different section properties. The methods of analysis are described.
HS-013 308

SMALL COMPUTER PROCEDURES AS TOOLS FOR STRUCTURAL DESIGNERS

G. A. Wardill 1970 Rept. No. Paper-8

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
IN HS-013 300

Computerized design, Body design, Structural analysis, Floors, Frame design, Loading tests, Door design, Computer programs, Graphic techniques, Plotters, Beams, Deflection

An example of how to estimate the beam-mode deflection of a production vehicle body by computerized design procedures is presented. The degree of accuracy obtained is shown by comparison with rig test results. Data preparation and processing times and the makeup of the computer program are discussed. It is suggested that, in the structural field at least, efficient computer utilization will only be achieved if more comprehensive instruction is given on the background of appropriate simplified programs.
HS-013 309

AUTOMOTIVE DESIGN WITH SPECIAL CONSIDERATION FOR SAFETY IN INTERIOR DESIGN

J. E. Fallis 1970 Rept. No. Paper-10

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Safety design, Ergosphere, Interior design, Human factors engineering, Anthropometry, Passenger compartments, Accident prevention, Seat design, Comfort, Symbols, Standardization, Visibility, Forecasting, Instrument panels, Control location, Dials

Vehicle interior safety design combined with human factors engineering is more effective in preventing accidents than additive cushioning after the event. Seats must be designed to assure driver alertness, concentration and long term comfort. Standardized symbols should be used to label instrument panel controls. It is suggested that in the future instrument panels may be located further from the driver; controls will have to be embedded alongside the driver and he will learn to identify the control by touch and position; the driver could be seated in a higher position than the passengers; dials may provide the driver with information in just the amount of detail required for the driving situation with the flick of a switch.

HS-013 311

CHASSIS FRAMES

D. W. Sherman 1970 Rept. No. Paper-11

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Frame design, Frame tests, Crush tests, Durability tests, Vehicle riding qualities, Vehicle stability, Body design, Body mounting, Energy absorption, Test equipment, Ride simulators, Structural design, Accident simulation

Over the years the role of the frame in American passenger cars has changed greatly. More recently, the virtue of the frame with respect to collision damage and passenger safety is receiving increasing attention. After a short discussion of frame function, the evolution of the frame as influenced by major changes in other vehicle components is explored. Special laboratory equipment for durability testing and analysis of frame structures is complemented by a machine for crushing vehicles and components to simulate the effects of collisions. This permits a step-by-step analysis and provides data for design improvement.

HS-013 312

HUMAN FACTORS INFLUENCING CONTROL POSITIONS

G. R. W. Simmonds 1970 24refs Rept. No. Paper-12

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Human factors engineering, Control location, Ergosphere, Instrument panel design, Anthropometry, Driver modeling, Knobs, Driver reaction time, Visibility, Comfort, Force, Standardization, Impact protection

The ergonomic aspects of interior fittings is discussed with special reference to safety. Current methods of measuring percentiles of driver reach employ mechanical simulation of drivers. Fitting trials with a group of people in a seat mock-up provide a more cumbersome, but probably more exact, method of assessing the reachability of a particular layout. A properly selected, stratified sample of up to 40 drivers should be used. Driver reaction time, visibility, comfort, and force must also be considered in control location. The more frequently used controls should be more conveniently placed. However, it is often difficult to determine priority. In car design, it is probably better to group controls according to function, and control location should be standardized. Controls and related warning lights should be adjacent, identifying symbols should be placed above or on the controls, and conventions must be observed regarding the direction of motion of controls.

HS-013 313

AUTOMOBILE BODY TESTING TECHNIQUES

W. R. Greenaway 1970 Rept. No. Paper-13

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Body tests, Static tests, Torsion, Bending, Deflection, Test equipment, Loading (mechanical), Drop tests, Strength (mechanics), Stiffness, Compliance tests, Automobile bodies

Test procedures, test equipment and measurement and loading methods used in performing static tests on automobile bodies are described. Tests performed on complete body shells include bending, torsion, and door drop tests. Testing of subassemblies and automobile safety features is mentioned.

HS-013 314

THE EXPERIMENTAL INVESTIGATION OF BODY STRUCTURAL VIBRATION

M. Rodger 1970 8 refs p108-25 (1969-70) Rept. No. Paper-14

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Automobile bodies, Vibration analysis, Noise sources, Body design, Vibration response, Resonant frequency, Excitation, Acceleration response, Sound intensity, Damping, Resonance, Frequencies, Bending, Torsion, Body volume, Velocity, Test equipment, Transducers, Accelerometers, Acoustic measurement, Automobile modification, Vibration, Stiffness

A single-point excitation technique and the necessary instrumentation used to investigate the noise and vibrational properties of vehicles are described. To study these properties, use has been made of mobility methods, mobility being defined as the ratio velocity response/force input. This technique is adequate to define the basic behavior of bare body shells. In addition to its use as a development tool it has shown the sort of variations which can be expected between nominally similar bodies; and that modifications can significantly reduce vibration and noise response. There are limitations to this procedure in accurately assessing the effects of body modifications, and in correlating body shells with complete vehicles. The case is presented for a multipoint excitation system which has great potential in this work.

HS-013 315

Group 5D—Design

SOUND DAMPING CONTROL OF AUTOMOBILE BODY STRUCTURES

A. M. Chappuis 1970 Rept. No. Paper-15
Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Vehicle noise, Noise control, Damping, Insulation, Acoustic measurement, Sound intensity, Resonant frequency, Noise sources, Body design, Vibration control, Vibration measurement, Sound absorbing materials, Special analysis

The acoustic comfort of automobiles must be determined by physical measurements and subjective judgment. Discomfort is caused by resonance and excess sound level. Methods for the elimination of body resonance are presented. A review of progress in sound level reduction during the last 10 years shows that improvements have resulted mainly from modification of the car body rather than of the noise sources. Noise transmission can be reduced by vibration insulation, damping, sound insulation, and absorption.

HS-013 316

MODERN METHODS OF TRANSLATING A STYLING MODEL TO A BODY DRAFT AND TOOLING

D. W. Davy 1970 4refs Rept. No. Paper-16
Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Body design, Computerized design, Computerized simulation, Automobile modeling, Graphic techniques, Tools, Engineering drawings, Visual aids, Mathematical models

Computerized methods of translating the shape of a clay model into a body draft have been developed. Approaches used to obtain a description of the exterior shape within the computer include providing the stylist with a computer system which he will use to aid the styling of the vehicle, thus obtaining a mathematical model of the exterior surface at the conception stage or allowing the stylist to produce a clay model and use this as a basis for obtaining a mathematical model of the surface. The limitations of both methods are outlined. The description of the exterior shape of an automobile contained in the computer could be used to aid the design and manufacture of press tools, and such a process is outlined.

HS-013 317

POSSIBLE IMPROVEMENTS IN RIDE COMFORT

D. Ryba 1973 25 refs
Vehicle System Dynamics v2 n1 p1-32 (Mar 1973)

Vehicle riding qualities, Comfort, Suspension system design, Vibration control, Spring damping, Spectral analysis, Vehicle mass, Deflection, Human body mass, Pavement surface texture, Tire loads, Tire forces, Axles, Dynamic loads, Vibration perception threshold, Vibration protection, Acceleration damping, Equations of motion, Springs

The random vertical vibration of two linear models of sprung mass with a passenger on the seat is numerically solved. The input signal has a power spectrum of a real road. The acceleration of the passenger is frequency-weighted according to two various criteria. The gain in comfort obtained by lowering the natural frequency of the sprung mass is calculated along with

the dynamic and static spring deflections. In addition, a solution of the vibration of the unsprung mass with evaluation of a possible improvement is presented. It is concluded that the usual suspension system, which is in principle a two-mass system, has to be changed into a three-mass system to improve ride comfort.

HS-013 322

IDENTIFICATION OF SYMBOLS FOR MOTOR VEHICLE CONTROLS

Volkswagenwerk A. G. (West Germany), V16800
D. Frank, N. Koenig, R. Lendholt 1973 11p 7refs Rept. No. SAE-730611
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Symbols, Standardization, Instrument panel design, International compacts, Test volunteers, Questionnaires, Color, Contrast

Identification of some well-known and some new instrument panel control symbols was investigated by a questionnaire given to Volkswagenwerk A. G. employees and factory visitors. The identification rate of visitors was rather small in relation to the results of employees. A substantial decrease of identification was found in the group older than 30 years. Women were less successful at immediate identification than males, and no effects were found in relation to the subject's profession. The importance of international standardization of symbols is emphasized. Recommendations for further development of symbols are presented, and it is suggested that white symbols on a black background be used.

HS013 276

5E. Door Systems**BODY COMPONENTS**

A. E. Norman 1970 Rept. No. Paper-6
Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Door design, Vehicle safety standards, Production control, Cost minimization, Power windows, Handles, Door hinges, Door latches, Door locks, Standardization, Forecasting

The greatest body design problem for modern European vehicles is that posed by the door because hinges, latches, handles, locks, and a window must all be fitted into a very confined space. In the future window regulators and door locks will probably become primarily power operated, door components will be standardized to reduce production costs, safety legislation will require very high-strength door latches, and maintenance-free materials will be used to improve the door system function.

HS-013 307

5F. Fuel Systems**CLOSED-LOOP EXHAUST EMISSION CONTROL SYSTEM WITH ELECTRONIC FUEL INJECTION**

Bosch (ROBERT) G.m.b.H. (West Germany), B21900
R. Zechmann, G. Baumann, Baumann, 10c H. 1973 8P 2REFS
Rept. No. SAE-730566

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Exhaust emission control, Electronic fuel injection, Air fuel ratio, Oxygen detectors, Exhaust emission control device tests, Stoichiometry, Catalytic converters, Catalysts, Durability, Feedback control

Federal exhaust emission standards for 1976 model year automobiles presumably demand the catalytic conversion of the pollutants involved. Provided the air fuel ratio is maintained at a stoichiometric value, some problems, such as fuel economy, can be solved. A closed-loop system was developed, consisting of an electronic fuel injection system and a special oxygen sensor in the exhaust manifold. First results on vehicles indicate that this control system offers a promising solution to the reduction of harmful contaminants. The closed loop system can be used with a three-way catalytic converter or with a dual bed system. It has not yet been investigated whether the durability of the two systems is adequate, apart from the general problems of the durability of each catalyst.
HS-013 246

NICKEL-COPPER ALLOY NITROGEN OXIDES REDUCTION CATALYSTS FOR DUAL CATALYST SYSTEMS.

Esso Res. and Engineering Co., E21000; Gould, Inc., G25700
L. S. Bernstein, R. J. Lang, R. S. Lunt, G. S. Musser, R. J.
Fedor 1973 14p 8refs Rept. No. SAE-730567
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Nickel copper alloys, Reduction catalysts, Dual bed catalyst systems, Nitrogen oxides, Catalyst tests, Durability tests, Oxidation catalysts, Chemical reactions, Reactors, Carburetor design, Engine dynamometers, Carbon monoxide, Hydrocarbons, Nitrogen, Warmup, Operating temperature, Thermal factors, Oxidation, Air fuel ratio

Progress in optimizing the design of dual catalyst systems incorporating GEM nickel, copper alloy catalysts, to provide rapid warmup, maintenance of operating temperature, controlled carburetion to maximize nitrogen oxides removal, and to minimize the risk of over-temperature, is discussed. Rapid warmup of the catalyst system can be obtained by keeping nitrogen oxides reduction catalyst mass low and making use of the ability of the reduction catalyst to oxidize carbon monoxide (CO), hydrogen, and hydrocarbons (HC) under net reducing conditions. This ability to oxidize CO, hydrogen, and HC is also used to maintain system operating temperature. Carburetion is controlled to plus or minus 0.4 air fuel ratio with a four-barrel, research carburetor which is described in detail. Results of durability tests of GEM catalysts show a significant improvement over the published state of the art for nitrogen oxides reduction catalysts.
HS-013 247

THERMAL RESPONSE AND EMISSION BREAKTHROUGH OF PLATINUM MONOLITHIC CATALYTIC CONVERTERS.

Mobil Res. and Devel. Corp., M54600
C. R. Morgan, D. W. Carlson, S. E. Voltz, 1973 14p 13refs Rept.
No. SAE-730569
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Catalytic converters, Monolithic catalysts, Platinum, Thermal factors, OVERHEATING, Melting, Engine dynamometers, Temperature endurance tests, Exhaust gas flow patterns, Mass transfer, Operating temperature, Unburned fuels, Carbon monoxide, Hydrocarbons, Methane, Propylene, Heat transfer, Air injection

Test of an Engelhard PTX-5 converter indicate that generally, the converter temperature increase rate was sufficiently slow to allow time for activating an overtemperature protection device. The converter melted upon total ignition loss with the throttle open. Melting can be prevented by decreasing the unburned fuel pumped to the converter. Emissions breakthrough occurs at greater than 40 standard cubic feet per minute (scfm)/converter and increases with flow rate; decreases with increasing catalyst temperature; increases for carbon monoxide with increasing hydrocarbons; and is total for methane below 1150F at 64 scfm, and generally is greater for methane than propylene. More severe breakthrough problems which may be associated with the secondary air supply system may be controlled by larger, more powerful air pumps and perforated plate baffles. Breakthrough can generally be decreased by larger converters, and monolithic forms designed for more rapid gas-solid heat and mass transfer.
HS-013 248

INITIAL OXIDATION ACTIVITY OF NOBLE METAL AUTOMOTIVE EXHAUST CATALYSTS

General Motors Corp., G06600
G. J. Barnes, R. L. Klimisch 1973 11p 11refs Rept. No.
SAE-730570
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Catalytic converters, Exhaust emission control device tests, Catalyst tests, Metallic catalysts, Oxidation catalysts, Palladium, Platinum, Hydrocarbons, Carbon monoxide, Exhaust emission measurement, Catalytic converter location, Exhaust emission tests, Manifold air injection systems, Density, Thermal factors, Mass, Performance characteristics, Exhaust manifolds

Full-scale vehicle tests were performed on catalytic converters containing alumina-supported platinum (Pt) and palladium (Pd) catalysts to control hydrocarbons (HC) and carbon monoxide (CO) emissions. Catalytic converters containing 70-80 cubic inches of catalyst were installed at two locations. The vehicle was equipped with an exhaust manifold air injection system. Homogeneous thermal reaction in the exhaust manifolds played a significant role in the overall control of HC and CO. Four Pt catalysts, three Pd catalysts, and one Pt-Pd catalyst were prepared and evaluated. Hydrocarbon conversion efficiencies varied 62-82%. Corresponding CO conversions ranged 89-97%. Catalyst performance was best in the front converter location which produced higher bed temperatures. There were no large differences in the emission control capabilities of Pt versus Pd catalysts. In this vehicle, it appeared that 0.04 tray ounce of either Pt or Pd gave sufficient initial oxidation activity to reduce HC and CO emissions to the desired 1975-1976 federal emission limits.
HS-013 249

SENSOR FOR ON-VEHICLE DETECTION OF ENGINE EXHAUST GAS COMPOSITION

General Motors Corp., G06600
W. J. Fleming, D. S. Howarth, D. S. Eddy 1973 18p 13refs Rept.
No. SAE-730575

Group 5F—Fuel Systems

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Exhaust composition, Exhaust gases, Exhaust emission control, Gas detectors, Air fuel ratio, Zirconium oxides, Prototypes, Voltage, Exhaust emission measurement, Degradation failures, Resistance, Engine dynamometers, Exhaust densities, Equations, Sensors, Oxygen, Carbon monoxide, Carbon dioxide, Thermal factors, Engine speeds, Loading (mechanical), Performance characteristics, Engine operating conditions, Ceramics, Lean fuel mixtures, Rich fuel mixtures, Stoichiometry

Zirconia exhaust sensors were installed in situ on engines operated under controlled dynamometer conditions. Degradation failures were associated with the platinum electrodes and the ceramic electrolyte of the sensors. Performance degradation was first observed within 10 hours of exhaust exposure time, whereas destructive failures occurred at 50 plus or minus 20 hours. It was estimated that the sensor fully responded to changes of air fuel ratio within 50 milliseconds, and that upon engine startup the sensor warmed up and supplied usable voltage signals within 10 seconds. Depending upon whether the air fuel ratio was lean or rich, the sensor electromotive force (emf) signal correlated with the exhaust concentrations of either oxygen or carbon monoxide, respectively. Engine speeds and loads influenced the resultant value of sensor emf voltage. Variations of sensor emf due to changing engine conditions were accounted for by corresponding variations of exhaust temperature.

HS-013 254

TRANSDUCERS FOR ENGINE MANAGEMENT

Lucas (Joseph), (Electrical) Co. Ltd. (England) 1.24000
For primary bibliographic entry see Fld. 5D.

HS-013 255

FUEL EFFECTS ON OXIDATION CATALYSTS AND CATALYST-EQUIPPED VEHICLES

Esso Res. and Engineering Co., F21000

A. H. Neal, E. E. Wigg, E. L. Holt 1973 14p 16refs Rept. No. SAE-730593

Presented at Automobile Engineering Meeting Detroit, 14-18 May 1973.

SAE

Oxidation catalysts, Catalyst tests, Catalyst poisoning, Catalytic converters, Fuel composition, Exhaust emission tests, Exhaust emission measurement, Lead, Carbon monoxide, Hydrocarbons, Sulfur, Lead poisoning, Platinum, Engine dynamometers, Fuel volatility, Gas analysis, Performance characteristics, Exhaust composition, Gravity, Lead free gasoline, Fuel properties, Fuel economy, Vehicle performance, Low lead gasoline

The effects of lead and sulfur in gasoline on the activity of platinum oxidation catalysts were studied using engine dynamometer units. No poisoning due to sulfur was observed. Prolonged operations with lead up to 0.07 g/gal. reduced the hydrocarbon (HC) conversion activity in proportion to time and lead concentration, but did not affect carbon monoxide (CO) conversions. However, catalysts exposed to the equivalent of 25,000 miles operation with a fuel containing 0.07 g/gal. lead still met the original 1975 federal emissions standards. Exposure of platinum catalysts to exhaust from fuel containing 0.5 g/gal.

was rapidly recovered when operations continued with a lead free fuel. The effects of gasoline volatility and gravity on vehicle emissions were determined for two oxidation catalyst control systems using modified 1973 vehicles. Fuel volatility and gravity did not significantly affect HC and CO emissions.

HS-013 268

STUDY OF THE DEACTIVATION OF BASE METAL OXIDE OXIDATION CATALYST FOR VEHICLE EMISSION CONTROL

Ford Motor Co., F18600

E. C. Su, E. E. Weaver 1973 Rept. No. SAE-730594

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Exhaust emission control, Oxidation catalysts, Pelletized catalysts, Catalyst tests, Tetraethyl lead, Leaded gasoline, Deposition, Carbon monoxide, Hydrocarbons, Oxidation, Catalytic converters, Exhaust emission control device tests, Vehicle mileage, Metal oxides, Base metal, Regression analysis, Lead sulfate, Vanadium, Catalytic converter location, Lead free gasoline, Low lead gasoline, Catalyst poisoning

The deactivation of a pelletized base metal oxide catalyst was evaluated in a fleet test for accumulation of up to 18,000 miles in customer-type driving. The test was conducted to determine the effects of two converter locations and four tetraethyl lead levels (0.06-3.17 g/gal.) in the fuel on the effectiveness of the catalyst for carbon monoxide (CO) and hydrocarbon (HC) emission control. Lead deposits found on used catalyst samples represented about 50% of the lead in the fuel based on an assumed gas mileage of 17 miles per gallon, and was nearly in direct proportion to the fuel lead content and independent of converter location. The catalyst activity for CO and HC oxidation was adversely affected by lead deposition. Catalysts from front-mounted converters suffered a greater loss of surface area, but a nearly twofold variation in catalyst surface area had a relatively small effect on HC oxidation.

HS-013 269

EFFECTS OF ENGINE OIL COMPOSITION ON THE ACTIVITY OF EXHAUST EMISSIONS OXIDATION CATALYSTS

General Motors Corp., G06600

N. E. Gallopoulos, J. C. Summers, R. L. Klimisch 1973 12p 9refs Rept. No. SAE-730598

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Oxidation catalysts, Oils, Catalyst tests, Exhaust gases, Engine tests, Low lead gasoline, Lead free gasoline, Engine dynamometers, Reactors, Fuel consumption, Oil consumption, Test reproducibility, Durability, Platinum, Palladium, Carbon monoxide, Copper, Chromium, Phosphorus, Lead, Sulfur, Pelletized catalysts, Test equipment, Propylene

Platinum, palladium, and copper-chromium oxidation catalysts for exhaust emission control were exposed to exhaust gases from a steady state engine dynamometer test in which the amount of oil consumed per unit volume of catalyst was high. When unleaded gasoline was used, conventional SE oil caused somewhat greater loss of catalyst activity than an ashless and

indicated that phosphorus from the conventional oil was probably responsible for the difference. However, a test run with low lead gasoline and clean oil caused much greater catalyst activity deterioration than either of the tests with unleaded gasoline. The findings of this study indicate that engine oil effects on catalyst durability are of secondary practical importance, and that conventional SE engine oils will probably be acceptable for cars equipped with catalytic converters for the oxidation of exhaust hydrocarbons and carbon monoxide.

HS-013 270

THE NEEDS OF COMMUNITIES AND LEGISLATION OF THE ROAD TRANSPORT VEHICLE

A. D. F. Bampton 1972 6refs

International Journal of Environmental Studies v3 n3 p229-35 (Jul 1972)

Environmental quality regulations, Vehicle noise, Noise control, Noise control regulations, Sound intensity, Vehicle air pollution, Exhaust emission standards, Exhaust emission control, Smoke control, Diesel engine exhaust emissions, Great Britain, United States, International factors, Benefit cost analysis, Intergovernmental relations

Vehicle noise control regulations in Great Britain are discussed and British and American diesel engine smoke control regulations are compared. Action taken in the U. S. to control exhaust gas emissions is described. It is concluded that there is a very real need to establish basic criteria concerning the control of man's pollution of the environment from all sources. So far as the transportation industries of trading nations are concerned, criteria on a global basis are necessary in order that countries may have common ecologically and economically balanced standards.

HS-013 284

LEGISLATION AND THE MOTOR CAR

For primary bibliographic entry see Fld. 5D.

HS-013 285

THE IMPACT OF AUTOMOTIVE TRANSPORTATION ON THE ENVIRONMENT AND LEGISLATIVE MEASURES FOR ITS CONTROL: UNITED STATES EXPERIENCE

J. C. D. Blaine 1972 27refs

International Journal of Environmental Studies v3 n3 p243-52 (Jul 1972)

Environmental quality regulations, Air pollution laws, Exhaust emission standards, Highway beautification, Noise control regulations, Vehicle noise, Billboards, Junkyard regulations, Landscape design, Environmental planning, Federal role, Law enforcement, State action, Exhaust emissions, Federal aid, Federal state relationships, Government industry cooperation, Urban planning

Federal legislation enacted to improve the quality of the environment, including air pollution control laws, exhaust emission standards, vehicle noise control regulations, and regulation of highway beautification, is reviewed. There is a need for cooperative action on the part of the federal, state, and local governments, automotive and oil industries, and an aroused populace in the formulation and the rigid enforcement of corrective environmental policies and practices pertaining to automotive transportation.

HS-013 286

Manufacturers, Distributors, And Dealers—Group 5L

5G. Glazing Materials

WINDSCREENS OF THE FUTURE

S. E. Kay 1970 Rept. No. Paper-5

Presented at a symposium entitled Body Engineering, arranged by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering, London.
In HS-013 300

Windshield design, Forecasting, Glass standards, Windshield research, Laminated glass, Injury prevention, Windshield impact tests, Field of view, Glass fracture behavior, Nomographs, Great Britain, Abrasion resistance, Glare reduction, Comfort, Heated windshields, Coatings, Bonding

It is suggested that windshields of the future will be constructed of laminated glass with an interlayer whose thickness and other properties will optimize safety and mechanical performance of the laminated composite. Head impacts of up to 50 mph will cause only slight lacerative injuries, and pedestrians will survive similar impacts. Visibility sufficient for all normal driving purposes will be maintained after impact with flying objects and windshields will not be penetrated by these objects. Heat and glare reduction characteristics will be included which may lead to larger glazed areas. The windshield will be electrically heated for demisting and deicing by devices which may also reduce heat and glare. It will be more resistant to abrasion and have great mechanical strength and form part of the body shell structure. It will probably be mechanically or adhesively bonded to the aperture.

HS-013 306

BODY COMPONENTS

For primary bibliographic entry see Fld. 5E.

HS-013 307

5L. Manufacturers, Distributors, And Dealers

MAKING THE AMERICAN MOTORS' BUYER PROTECTION PLAN WORK

American Motors Corp., A35400

R. M. Miller 1973 10p Rept. No. SAE-730586

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

American Motors Corp, Consumer protection, Warranties, Defective vehicles, Corporate responsibility, Quality control, Defect correction, Dealers, Consumer attitudes, Surveys, Reliability

Increased emphasis upon achievement of customer satisfaction has forced American Motors' quality and reliability activities to develop new techniques for identifying and correcting field product problems. Features of the American Motors' Buyer Protection Plan are described; methods used to provide product problem information feedback are reviewed; and fleet performance reporting, new model dealer reaction surveys, warranty parts return programs, and specialized warranty analysis are discussed.

HS-013 264

Group 5N—Occupant Protection**5N. Occupant Protection****ON THE OCCUPANT CRASH PROTECTION SYSTEM OF THE NISSAN ESX**

Nissan Motor Co Ltd. (Japan), N60600
For primary bibliographic entry see Fld. 5D.
HS-013 266

IMPROVED MECHANICAL RESTRAINTS FOR FRONT SEAT COMPACT CAR OCCUPANTS

Minicars, Inc., M46400
D. Friedman 1973 15p 2refs Rept. No. SAE-730603
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Air bag restraint systems, Chest restraints, Restraint system tests, Front seat passengers, Compact automobiles, Impact sleds, Impact tests, Human deceleration tolerances, Restraint system design, Anthropomorphic dummies, Occupant kinematics, Restrainer bars, Rebound, Head restraints, Knee restraints, Angle impact tests

Various efforts to develop and improve air bags for front seat compact car occupants are summarized. An alternative chest restraint system was developed and tested. The restraint system consists of a deployable stroking chest bolster; a stroking knee restraint; and a head wedge. The results of 140 system sled tests and of two full-scale crash tests with the system are presented. Several tests were conducted with offset and obliquely positioned occupants. Numerous other tests were also conducted to compare the 5th percentile female with the 50th and 95th percentile male.
HS-013 274

TRAFFIC SAFETY: PROBLEMS AND SOLUTIONS

For primary bibliographic entry see Fld. 3D.
HS-013 281

THE DESIGN OF HYBRID CUSHION CARS

D. Foster 1972
International Journal of Environmental Studies v3 n3 p217-21 (Jul 1972)

Occupant protection, Air bag restraint systems, Automobile interior design, Padding, Seat belts, Impact protection, Crash phase, Secondary collisions, Human body impact tolerances, Harnesses, Seat belt caused injuries, Mathematical analysis, Stopping distance, Vehicle safety standards, Safety standards compliance, International factors

Motor Vehicle Safety Standard 208 is performance-based in specifying a car crash speed up to which the occupants will not be injured. The two leading contenders for meeting this standard are the inflatable air bag and the Hybrid Cushion Car. The principle of the Hybrid Cushion Car is to combine safety harnesses with deep interior padding. The design is fully optimized in a specific mathematical formula which includes the Newtonian laws for retardation and also the established safe medical values as to non-injurious impact levels. Much of the design has a common philosophy with the techniques used by NASA to bring spacemen down safely at splashdown. The indications are that the majority of the world's car industry will use the Hybrid Cushion Car design as the means to actualize Standard 208 and the equivalent legislation being prepared in other countries.
HS-013 282

LEGISLATION AND THE MOTOR CAR

For primary bibliographic entry see Fld. 5D.
HS-013 285

AUTOMOBILE INJURIES--THE FORGOTTEN AREA OF PUBLIC HEALTH DENTISTRY

For primary bibliographic entry see Fld. 1B.
HS-013 290

AUTOMOBILE INJURIES--THE FORGOTTEN AREA OF PUBLIC HEALTH DENTISTRY

For primary bibliographic entry see Fld. 1B.
HS-013 290

SEAT BELTS: FACTORS INFLUENCING THEIR USE. A LITERATURE SURVEY

G. Phaner, M. Hane 1973 42refs
Accident Analysis and Prevention v5 n1 p27-43 (Apr 1973)

Seat belt usage, Seat belt campaigns, Driver attitudes, Passenger attitudes, Age factors, Sex factors, Sociological factors, Driver mileage, Vehicle age, Public opinion, Seat belt usage laws, Risk taking, Psychological factors, Personality, Safety program effectiveness, Program evaluation, Safety propaganda, Mass media, Posters, Laboratory tests, Fear, Reviews, Sweden, England, United States, Finland

Studies of seat belt usage reported between 1960 and 1970 from England, Finland, Sweden, and the United States are reviewed. The output from seat belt usage research has been meager, the most consistent findings being the differences in use levels between highway and city driving and the relation of belt usage and educational level. Users and nonusers both expressed a favorable attitude towards seat belts. However, belief in seat belt effectiveness is not enough reason to wear them. Seat belt campaign effects have been small or none at all. Sociological and psychological factors which affect seat belt usage are investigated. An effective campaign must reach a threshold value in intensity and also must be allowed to work for a longer period of time than has been usual. The main promotional efforts must be made in smaller units like work organizations, clubs, schools, and associations, with the mass media as supportive only.
HS-013 293

THE EFFECT OF A DANISH PROPAGANDA CAMPAIGN FOR CHILDREN TO BE PLACED IN THE BACK SEAT OF CARS. RESEARCH NOTE

N. O. Jorgensen, K. Steen-Petersen 1973
Accident Analysis and Prevention v5 n1 p77-9 (Apr 1973)

Child safety, Seat occupation by age, Rear seat passengers, Safety campaigns, Safety propaganda, Child safety education, Safety program effectiveness, Program evaluation, Injury prevention, Denmark

From available Danish statistics it is possible to estimate that the risk for children of being in the front seat is approximately three times the risk of being in the rear seat. From March 1970 to April 1971 10,763 cars with child passengers were observed in Copenhagen to test the effect of a minor campaign for placing children in the rear seat in automobiles. The campaign emphasized child safety education. In eight out of nine cases there was a decrease in the percentage of children in the front seat from March 1970 to April 1970. Comparing April 1970 to

April 1971 again there was a drop in eight out of nine cases. Comparing March 1970 to April 1971, the percentages dropped in all the nine cases. Approximately 20 child injuries per year are expected to be prevented if the campaign's effect remains constant.
HS-013 296

THE REALISM OF VEHICLE IMPACT TESTING

For primary bibliographic entry see Fld. 5D.
HS-013 302

50. Propulsion Systems

INTERACTION DYNAMICS OF AN INFLATING AIR BAG AND A STANDING CHILD

Ford Motor Co., F18600
H. Wu, S. C. Tang, R. C. Petrof 1973 16p 13refs Rept. No. SAE-730604
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Air bag restraint systems, Child safety, Air bag deployment forces, Impact forces, Occupant positioning, Standing (body position), Restraint system tests, Air bag inflation pressure, Air bag inflation time, Dummies, Acceleration response, Mass, Mathematical models, Occupant protection, Simulation models, Computerized simulation

An analytical treatment of a mechanical-mathematical model of an air bag inflation process integrated with a model for the interaction between the air bag and a standing child dummy is presented. The inflation model consists of a one-dimensional gas dynamics analysis of the flow system which delivers the gas to inflate the bag. The interaction model then provides a method for calculating the forces exerted by the inflating bag on the standing child. The results show that the unacceptably high contact forces recorded in standing-child air bag tests are due to impact of the unopened portion of the bag on the standing child. A single-membrane concept is suggested to reduce this impact severity.
HS-013 275

5Q. Safety Defect Control

MAKING THE AMERICAN MOTORS' BUYER PROTECTION PLAN WORK

American Motors Corp., A35400
For primary bibliographic entry see Fld. 5L.
HS-013 264

5R. Steering Control Systems

HANDLING AND STABILITY. VOLVO'S EXPERIMENTAL SAFETY CAR

Volvo A.B. (Sweden), V17400
F. Jaksch 1973 27p 20refs Rept. No. SAE-730591
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Experimental automobiles, Safety cars, Automobile handling, Automobile stability, Volvos, Automobile design, Steering, Yaw, Simulation models, Computerized simulation, Steady

state, Loading (mechanical), Roll, Lateral acceleration, Mathematical models, Crosswind, Power steering systems, Torque, Cornering, Stiffness, Rollover tests, Axle loads, Understeer, Oversteer, Vehicle task simulation, Weight distribution

Simulation of steering tasks of the Volvo's experimental safety car indicates that many parameters influence vehicle handling, but not all have the same importance to the road holding characteristics of the vehicle. The weight distribution on the front and rear axles is one of the more important factors and can be influenced by the driver. For example, a fully loaded car may have a load of 40% on the front axle and 60% on the rear axle. This unbalanced distribution can cause problems for the driver in transient steering. It is important, therefore, that vehicles be designed so that even the worst weight distribution will not affect handling qualities to the extent that the driver has difficulty in controlling the steering. That is, handling performance should vary as little as possible regardless of disproportionate load distributions.
HS-013 267

ON THE DESTABILIZING EFFECT OF LIQUIDS IN VARIOUS VEHICLES, PT. 2

H. Bauer 1973 6refs
For Part 1 see HS-012 810.
Vehicle System Dynamics v2 n1 p33-48 (Mar 1973)

Vehicle stability, Equations of motion, Fluid dynamics, Aircraft, Spacecraft, Occupant modeling, Human factors, Mathematical representations, Lift, Thrust, Drag, Yaw, Pitch, Roll, Fluid flow, Vehicle dynamics, Vehicle design, Weight, Lateral force, Damping, Surface dynamics

Previous investigation shows that the unrestrained free surface of a liquid undergoes large excursions and endangers vehicle stability and response; This study indicates that with appropriate theoretical investigations a vehicle can be designed from the beginning in such a fashion that these sloshing liquid problems are minimized. The stability roots of a vehicle system describe the response resulting from any excitation. The optimization of vehicle response behavior is based upon the possibility of shifting the stability roots. If the location of the roots can be changed in the complex plane so that they exhibit a larger negative real part by changing the physical properties of the system, the system will exhibit enhanced stability, achieve a steady-state condition more efficiently, and absorb a disturbance more rapidly. Methods for determining the location of stability roots are discussed and linearized equations of motion of aircraft and spacecraft for small disturbances are presented.
HS-013 323

5T. Trucks And Trailers

1973 MOTOR TRUCK FACTS

111973 1275P REFS
Corporate author 1619 Massachusetts Ave., N. W. Washington, D. C. 20036

Transportation statistics, Production statistics, Sale statistics, Truck sales, Bus sales, Trucking industry, Motor carriers, Exhaust emission control, Recreational vehicles, Noise control, Vehicle registration, Vehicle age, Vehicle registration by model year, Trucks, Buses, Freight transportation, Vehicle mileage, School buses, Truck usage, Fleets, Economic factors, Imports, Exports, Taxation, Government vehicles, Employment

Group 5T—Trucks And Trailers

Truck and bus production, registration, usage, and ownership information are presented, and the economic impact of the trucking industry is discussed. Statistics are provided for production, sales, registration, usage, mileage, ownership, taxes, vehicle age, imports, exports, freight tonnage shipped, and employment provided by the truck and bus industries. Annual production and sales records for trucks and buses set in 1971 were surpassed in 1972 with 2,482,574 units produced and sales reached 2,533,918 units. Spurred by increased use for personal transportation and recreation, light trucks moved up to account for 84% of factory sales in 1972 and with those under 6,000 pounds gross vehicle weight accounting for 58% of all truck sales. Nearly 9.8 million U. S. households own light trucks. Trucks continued as the prime mover of manufacturers' freight shipments between cities handling 51% of such tonnage and freight movement over U. S. highways accounted for 7.6% of the Gross National Product.

HS-013 287

5V. Wheel Systems**THE CALSPAN TIRE RESEARCH FACILITY: DESIGN, DEVELOPMENT AND INITIAL TEST RESULTS**

Calspan Corp., C23600

K. D. Bird, J. F. Martin 1973 18p Iref Rept. No. SAE-730582

Presented at Automobile Engineering Meeting, Detroit, 13-18 May 1973.

SAE

Test facilities, Tire tests, Tire forces, Tire moments, Tire test equipment, Tire performance, Belts, Surface treatment, Surface friction, Lateral force, Tire slip motion, Air bearings, Calspan Corp., Speed, Tire loads, Drive systems, Tire balancing, Torque, Digital computers, Servomechanisms, Data reduction, Tire wear measurement, Wear tests, Bias belted tires, Tire inflation pressure, Cornering, Velocity

A tire research facility (TIRF) has been developed which uses appropriately surfaced steel belts to provide high speed flat simulated roadway surfaces for measuring loads, and speeds. The method of support of the moving roadway beneath the tire contact patch, the method of maintaining belt tracking under high side loads, the balance system used to measure forces and moments, and the computer control system used to operate and control the machine and completely process the data are presented. The effects of tire conditioning, wear, and inflation pressure; pavement surface stability; and road velocity on the performance of a free-rolling tire under dry road conditions are investigated using TIRF.

HS-013 260

NONDESTRUCTIVE TIRE INSPECTION STUDIES AT THE TRANSPORTATION SYSTEMS CENTER

Department of Transp. Transp. Systems Center, D17500

I. Litant 1973 18p Rept. No. SAE-730583

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Tire inspection, Nondestructive tests, Tire defects, Tire failures, Tire tests, X rays, Holographic interferometry, Ultrasonic tests, Inspection equipment, Transducers, Tire test equipment, Data banks, Coding systems, Data processing, Infrared scanning

A program is underway at the Department of Transportation/Transportation Systems Center to study the nondestructive detection of defects in tires, and to determine the relationship between these defects and tire failure; Ultrasonics, x ray, infrared, holography, and other techniques are being used to determine their effectiveness as well as their limitations in this task. The uses and modifications of the equipment for non-destructive inspection of new and retreaded tires are described. The use of a computer data bank for data collection, storage, and retrieval in the correlation of results is also discussed.

HS-013 261

LIGHT ALLOY WHEELS--THE GKN APPROACH

Guest, Keen, and Nettlefolds Ltd. (England), G29050

M. P. Jarrett, J. A. Thompson, W. D. Mendham 1973 15p Rept.

No. SAE-730613

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Wheels, Alloys, Wheel design, Casting, Machining, Surface treatment, Molding, Coating, Heat treatment, Manufacturing inspection, X ray analysis, Wheel inspection, Fatigue tests, Dynamic tests, Cornering, Impact tests, Loading (mechanical), Manufacturing standards, Bending, Guest, Keen, and Nettlefolds Ltd. (England)

Cast alloy wheels have evolved from racing applications and offer such advantages as high dimensional accuracy, giving improved wheel balance; machined bead seats, giving better contact between tire and rim; higher heat capacity and thermal conductivity, giving improved heat dissipation from tire and brakes; and reductions in unsprung weight, giving improved vehicle handling and performance. Light alloy wheels can be styled to complement and give a distinctive appearance to a specific car. Materials and design, casting, machining, inspection, and fatigue and impact test procedures used by Guest, Keen, and Nettlefolds Ltd. in light alloy wheel manufacturing are outlined, and the importance of adopting performance standards for wheels is discussed.

HS-013 278

NEW CONCEPTS OF TIRE WEAR MEASUREMENT AND ANALYSIS

Ford Motor Co., F18600

W. Bergman, W. B. Crum 1973 24p 37refs Rept. No.

SAE-730615

Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.

SAE

Tire wear measurement, Tire tests, Tire wear, Wear tests, Tire road contact forces, Tire properties, Pavement surface texture, Tire traction, Tire road conditions, Tire slip motion, Tire mechanics, Friction, Road tests, Tire pavement interface, Bias tires, Bias belted tires, Abrasion, Wheel slip, Equations, Tire forces, Lateral force, Longitudinal force, Tire force measurement, Mathematical analysis, Test equipment, Measuring instruments, Data processing, Data acquisition, Statistical analysis, Computerized test methods, Instrumented vehicle

A comprehensive analysis of tire tread wear utilizing new experimental and analytical techniques is presented. An explanation of the mechanics of tread wear is postulated and related to tire traction. A differentiation between grip and friction is introduced as an important factor controlling wear and traction,

proposed. New concepts are introduced which provide a basis for quantitative determination of factors controlling tread wear and provide new methods for measuring and calculating tire force energy, road surface abrasiveness, tire wear energy, and severity. Good correlation between tread wear and measured values of tire force severity and tire wear severity are established. A potential method for predictions of tire tread wear on a computer is developed.

HS-013 279

TIRE REINFORCEMENT NEEDS

A. B. Beindorff 1973 3refs

Based on a paper presented at the Akron Rubber Group fall meeting, Akron, 27 Oct 1972.

Rubber Age v105 n6 p51-5 (Jun 1973)

Tire industry, Consumer demand forecasting, Tire materials, Tire manufacture, Tire cords, Reinforcement (structures), Steel belted tires, Bias tires, Bias belted tires, Radial tires, Steel wire, Truck tires, Vehicle registration, Production statistics, Data analysis,

Factors involved in forecasting the tire industry are discussed and projections of tire construction types and tire reinforcement materials for passenger cars, light trucks, heavy trucks, and earthmovers are presented. The forecast indicates that steel will rapidly take nearly 90% of the radial passenger car tire belt market and will retain this market share as radials continue to increase their share of the total tire market from 1977-1982. In 1972 bias belted and radials each occupied about 1% of the light truck tire market. By 1977, the ratio should change to 80% bias, 4% bias belted, and 16% radial. By 1982, radials will increase to 35% at the expense of the bias construction. Radial light truck tires are expected to be 100% steel belted. It is expected that heavy truck and earthmover tires, 98% bias and 2% radial in

THE WET ROAD GRIP OF LORRY TYRES: A COMPARISON OF THREE TYPES

Transport and Road Res. Lab (England), T33900

T. Williams, J. K. Meades, B. S. Riley 1973 33p 4refs Rept. No.

TRRL-LR-544

Corporate author

Truck tires, Tire performance, Tire traction, Wet road conditions, Performance tests, Braking, Cornering, Tire tread patterns, Tire tests, Tire pavement interface, Crossply tires, Radial tires, Coefficient of friction, Lateral acceleration, Tire slip motion, Braking forces

Cornering and braking tests were carried out on three types of lorry tires: tires designed for use on the road (highway service tires); dual purpose tires with off road capability; and cross country tires designed specifically for soft ground operation. On wet smooth looking polished surfaces substantial differences in performance were observed; the order of merit from both types of test being: highway service tires; dual purpose tires; and finally cross country tires. All the patterned lorry tires gave better cornering and braking than smooth lorry tires but none gave as good braking as a typical patterned car tire, particularly for the peak braking coefficients on the wet mastic asphalt surface where the car tire produced a 2:1 improvement compared with the best results from the patterned lorry tires. It is thought that the differences noted in the above results arise mainly from differences in tread pattern.

HS-013 320

5W. Windshield-Related Systems

WINDSCREENS OF THE FUTURE

For primary bibliographic entry see Fld. 5G.

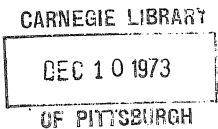
HS-013 306

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